

6. a) Describe the incoming supply system to a consumer three-phase installation . (3 marks)
- b) In a multi-storey building of 20 floors describe the best installation method to take the supply to each floor without using cables. (3 marks)
- c) For the building mentioned in (b) above, if the load per floor is estimated to be 150 kW/floor, determine the total load and draw a single line diagram for the switchboard. Indicate main breaker sizing and the outgoing circuit breakers (7 marks)
- d) If the system is backed up with an emergency standby generator, show on the schematic the arrangement required if the building is to be considered 100% essential. (7 marks)

END OF PAPER

EXAMINATION: AUTHORISATION B
February 2019

Paper II (Technology)

Time Allowed: 3 Hrs

WRITE ALL YOUR WORK IN THE ANSWER BOOK PROVIDED. EVERY ANSWER SHOULD INCLUDE ALL WORKINGS, NECESSARY DIAGRAMS AND FORMULAE.

START EACH ANSWER ON A FRESH PAGE.

Answer any FIVE Questions

1. a) Describe what happens in an electrical installation when a fault occurs and there is correct discrimination between protective devices. **(2 marks)**
- b) State what is meant by the term current rating as it applies to a circuit protection device such as fuses or mcbs. **(2 marks)**
- c) From the table below select the minimum size fuse that will give discrimination for a 100A fuse, if that fuse is the "downstream" fuse (that is, closest to the load). Provide an explanation for your selection. **(3 marks)**

Current Rating Amps	Pre Arcing time (I ² x10 ³)	Total Clearing time (I ² x10 ³)
80	14	40
100	17	60
125	25	85
160	62	160
200	105	250
250	200	550

- d) To test the integrity of the insulation you have a clip-on (clamp) ammeter with mA ranges. Describe how you would test the integrity of the insulation of the appliance using this test instrument. Include:
 - i) whether the appliance needs to be live.
 - ii) a test result that permits the appliance to be returned to service. **(2 marks)**
- e) A three-phase, 10 kW pump motor needs repairing. The motor has been isolated and cables disconnected. The motor cables are still connected to the DOL starter. State **TWO** precautions which must be taken to ensure the safety of persons and property while the work site is left unattended. **(2 marks)**
- f) Describe how isolating three-phase electrical equipment is different from switching off that three-phase electrical equipment. **(6 marks)**
- g) Describe **THREE** methods of preventing the reconnection of the electricity supply to an isolated fixed-wired, three-phase machine that is being worked on. **(3 marks)**

2. a) State why it is necessary to reduce the voltage for starting large three-phase induction motor. **(3 marks)**
 - b) With the aid of a clearly labelled circuit diagram describe the operation of:
 - (i) a direct on line starter for a three phase induction motor. **(7 marks)**
 - (ii) a Star-Delta starter for a three phase induction motor. **(7 marks)**
 - c) With the aid of a diagram show how the rotation of a three-phase induction motor can be reversed. **(3 marks)**
3. a) State with reasons the type of cable or installation wiring method you would recommend for:
 - (i) fireworks factory **(3 marks)**
 - (ii) petrol Station **(2 marks)**
 - (iii) a laundry **(2 marks)**
 - (iv) boiler Room **(3 marks)**
 - b) Show in detail with suitable sketches the stages in terminating a mineral insulated metal sheathed (MIMS) cable naming all the components used. **(8 marks)**
 - c) Explain why it is necessary to seal some types of cables termination against ingress of moisture. **(2 marks)**
4. Draw simple and well-labelled diagrams of the following motor-starters:
 - a) a simple direct-on-line starter. **(6 marks)**
 - b) a start-delta starter. **(6 marks)**
 - c) an auto-transformer starter. **(6 marks)**
 - d) Why does an induction motor require a starter? **(2 marks)**
5. a) Describe using a simple diagram the principle of a circuit-breaker. **(5 marks)**
 - b) Name **FIVE** advantages which a circuit-breaker has over a fuse. **(5 marks)**
 - c) When a circuit is broken a spark, or arc occurs. Name **FIVE** possible methods of reducing the effect of sparking when a circuit-breaker operates. **(5 marks)**
 - d) Using a diagram describe **ONE** type of contactor used in circuit-breakers. **(5 marks)**